3.7a Implicit Differentiation

differentiate:

$y = 1 - x^2$ explicit $\quad \frac{dy}{dx} = -2x \qquad y' = -2x$

$x^2 + y = 1$ implicit $\quad 2x + y' = 0$; solve for y' : $y' = -2x$

take der of each term (all with respect to x)

$y^2 = x$

$y' \cdot 2y = 1$ chain rule $\quad y' = \frac{1}{2y}$

solve for y (explicit) $\quad y = \pm x^{\frac{1}{2}}$

$y' = \pm\frac{1}{2} x^{-\frac{1}{2}}$

$y' = \pm\frac{1}{2} x^{-1/2} = \frac{1}{2} y$

$= \frac{1}{2y}$

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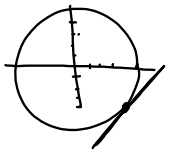
Find the slope of the circle at the point (3,-4)

$x^2 + y^2 = 25$



$2x + 2y \cdot y' = 0$

$2y \cdot y' = -2x$

$y' = \frac{-2x}{2y} = \frac{-x}{y}\Big|_{(3,-4)} = \frac{-3}{-4} = \frac{3}{4}$

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Implicit Differentiation Process

1. Differentiate both sides of the equation with respect to *x*.
2. Collect the terms with *dy*/*dx* on one side of the equation
3. Factor out *dy*/*dx*.
4. Solve for *dy*/*dx*.

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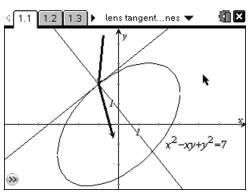
lens, tangents and normal lines

find the tangent and normal lines to the ellipse at the point (-1,2)

$x^2 - xy + y^2 = 7$



$2x - (xy' + y \cdot 1) + 2y y' = 0$

$2x - xy' - y + 2y y' = 0$

$-xy' + 2y y' = -2x + y$

$y'(-x + 2y) = -2x + y$

$y' = \frac{-2x+y}{-x+2y}\Big|_{(-1,2)} = \frac{2+2}{1+2\cdot 2} = \frac{4}{5}$

tan $y = \frac{4}{5}(x+1) + 2$

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higher order derivatives

Find the second derivative of *y* with respect to *x*

$2x^3 - 3y^2 = 8$

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